Inferential stastics.

- **Hypothesis testing**: It's technique used to make prediction of population data based on available sample data. Assump-tions are validated based on Hypothesis testing.

- **Null Hypothesis**: This type of conjecture in stats states that there is no diff b/w certain characteristics of a population or data generating process. we will assume the default result.

Ex-

- As coin has two faces. So we will assume coin is fair.
- Till court has given decision on any Person thieft we assume he/she is innocent.

• Alternate hypothesis: It's apposite of Null Hypothesis.

Ex-

• Earlier we need to say coin was fair and thief not happened till court order confirmed but in case of Alternate hypothesis we will assume coin is unfair & person is thief.

Confidence Interval (C.I)

It's range of estimates for an unknown Parameter. confidence interval provides us the range bounded till we can accept the parameter.

Ex-

let we tossed coin 1000 time and do same experiment for 4 times to get 60%, 55%, 50%, 68% times head.

Then we will ask domain expert how much % of head more we can accept for observation to be fair.

Suppose he says 85% which is not possible in practicle.

Based on C.I we accept null and alter--nate hypothesis.

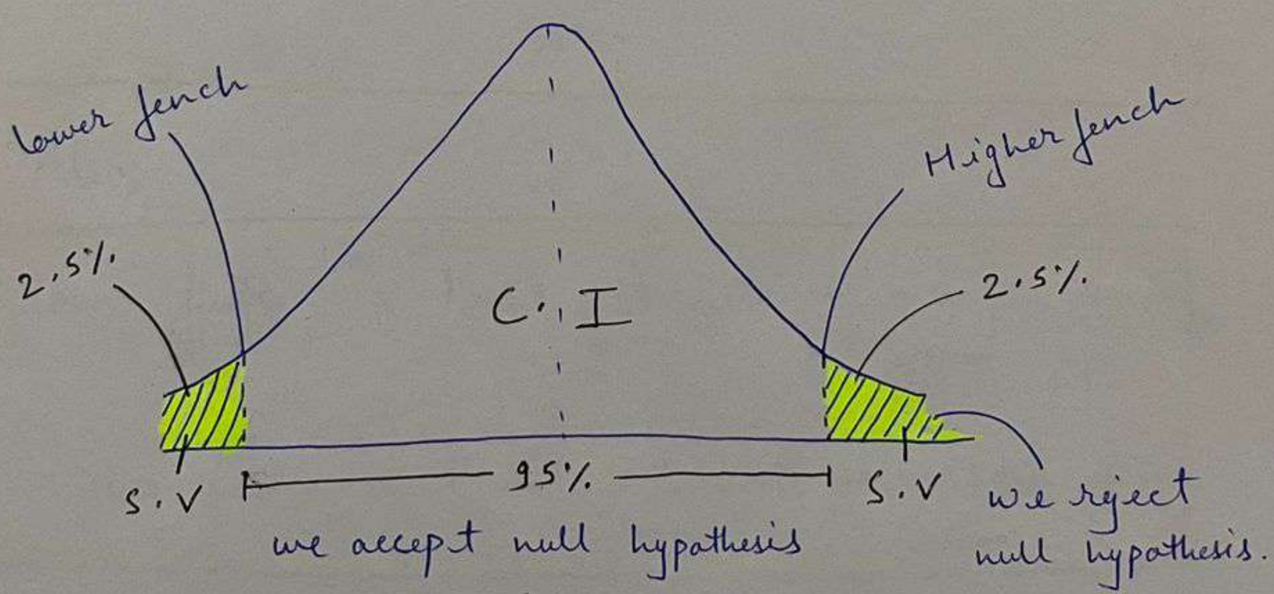
Signifance value:

It's measure of strength of the evidence that must be present in sample before we reject it.

$$\boxed{S.V = 1 - C.I}$$

Ex-

If C.I of a data is 95% then S.V is 5%. means for data lying in this 95% range we reject null hypothesis.



Point estimate :

Value of any statistics that estimates the value of a parameter is called point estimate.

Ex-

In inferential stats we estimate the value of papulation based on sample

Statistic — $\bar{x}$ — Sample mean

$\bar{x} \longrightarrow \mu$

we estimate values from sample mean and assume ~~from~~ Papulation.

Parameter — μ — Papulation mean

$$\boxed{\text{Point estimate} \pm \text{margin of error} = \text{Parameter.}}$$

Also,

$$\boxed{\begin{aligned} \text{Lower fence} &= \text{Point estimate} - \text{margin of error} \\ \text{Higher fence} &= \text{Point estimate} + \text{margin of error.} \end{aligned}}$$

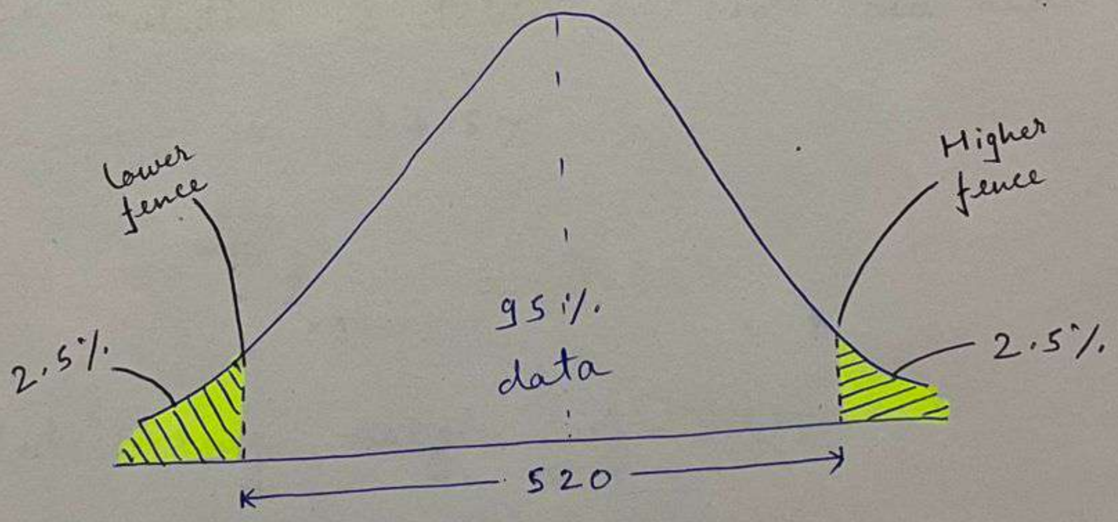
Ex- On the test of CAT exam of 25 peoples. with mean of 520, with a population standard deviation of 100. Consist a 95% C.I about the mean?

— From above we have:

$n = 25$, $\bar{x} = 520$, $\sigma = 100$,

C.I = 95%, S.V = 1 − C.I = .05%

Platting above case on graph.



Now,

$$\boxed{\text{Margin of error} = Z_{\alpha/2}\left(\frac{\sigma}{\sqrt{n}}\right)}$$

α = S.V

σ = std. deviation

n = no. of sample.

$$= Z_{.05/2} \times \left(\frac{100}{\sqrt{25}}\right)$$

$= Z_{.025} \times 20$

Considering Z-value to find the value of std. deviation it's away of mean on both side.

for negative Z table we have area under curve is 2.5%.

So,

$Z_{.025} = -1.96$

for positive Z table we have area under curve is 97.5%.

So,

$Z_{.975} = 1.96$

Calculating margin of error

$= 1.96 \times 20 = 39.2$

$$\boxed{\begin{array}{ll} \text{lower fence} = 520 - 39.2 = 480.8 \\ \text{Higher fence} = 520 + 39.2 = 559.2 \end{array}}$$

when we have total no.s of sample as n

if $\boxed{\begin{array}{l} n \geq 30 \quad - \quad Z \text{ test} \\ n < 30 \quad - \quad T \text{ test} \end{array}}$

when we use T test then margin

$\boxed{\text{of error} = t_{\alpha/2} \left[\frac{\sigma s}{\sqrt{n'}}\right]}$

n = degree of fredom $= n - 1 = n'$

Ex – A company manufactures bikes batteries with an average life span of 2yr or mare yr. An engineer belives the value to be less, using 10 samples he measure the average life span to be 1.8yr. with std. deviation of 0.15.

– State Null and Alternate Hypothesis

– At 99% of C.I is there enough evedience to dis card the no.

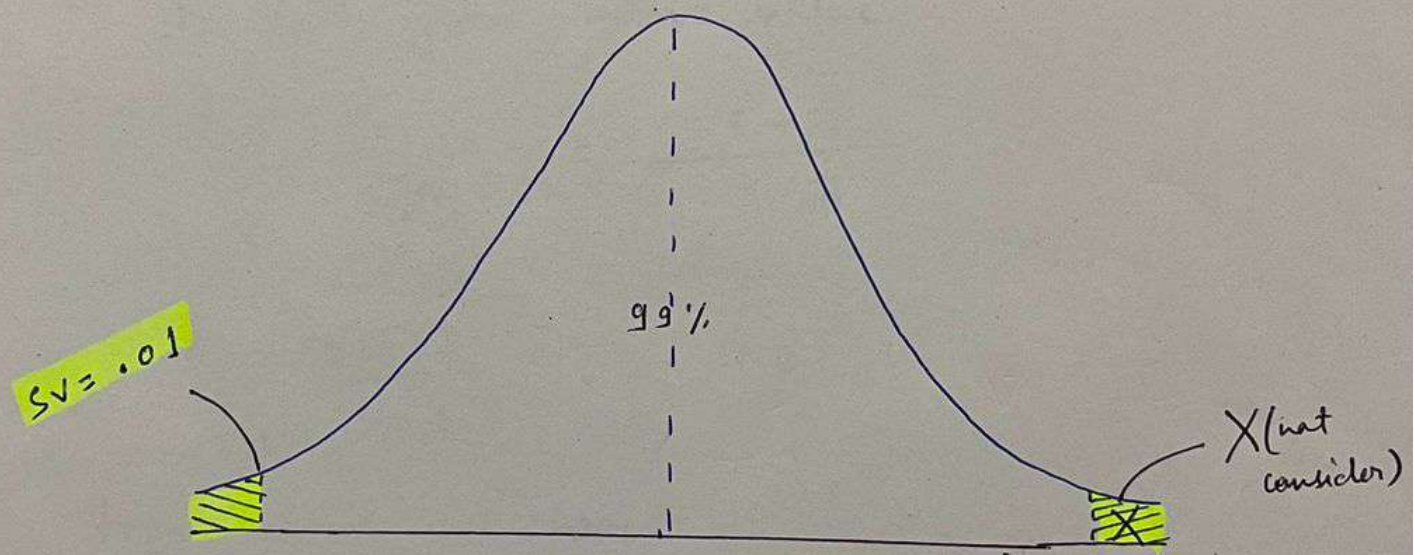
Null Hypothesis :

$H_0 \geq 2yr$ [company claim life span of battery]

Thus, $\mu \geq 2$

Alternate Hypothesis :

$H_1 = \mu < 2$



As in case of Alternate Hypothesis $\mu < 2$ as claimed by engineer. So, it unidirectional to left of mean.

we have,

$n = 10$, $\mu = 2$, $\bar{x} = 1.8$, $\sigma = .15$

C.I = 99%

$SV = 1 - .99 = .01$

As, $n < 30$ so we will apply t- test

degree of freedom $= n-1 = 10-1 = 9$

$T_{.01}$ on T-table for $n = 9$

St. σ away of mean $= -2.821$

Testing same after calculating value of t- test from above value

$$= \frac{\bar{x} - \mu}{\sigma_s/\sqrt{n}} = \frac{1.8 - 2}{.15/\sqrt{10}}$$

$$= \frac{-0.63}{0.15} = -4.21$$

From above we have:

$$-4.21 < -2.821$$

Mean while we reject the Null Hypothesis.
means battery life average < 2 yr.